

# PATENT ABSTRACTS OF JAPAN

(11)Publication number : **2001-322198**

(43)Date of publication of application : **20.11.2001**

(51)Int.Cl.

B32B 7/02

B32B 5/00

B32B 15/08

B32B 18/00

C08J 7/06

(21)Application number : **2000-145008**

(71)Applicant : **NIPPON MITSUBISHI OIL CORP**

(22)Date of filing : **17.05.2000**

(72)Inventor : **OSHIMA AKIO**

**KOBAYASHI TAKASHI**

**AOYANAGI KENICHI**

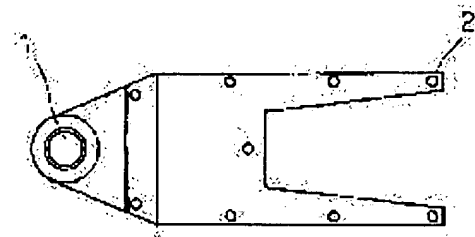
**UCHIDA DAISUKE**

**(54) MEMBER FOR CONVEYANCE MADE OF FIBER-REINFORCED COMPOSITE MATERIAL HAVING RESISTANCE TO ULTRAVIOLET LIGHT, AND MANUFACTURING METHOD THEREFOR**

(57)Abstract:

PROBLEM TO BE SOLVED: To provide a member for conveyance made of a fiber-reinforced composite material which hardly contaminates a material for precision equipment, even when the member is used for cleaning with the help of an ultraviolet light, while making best use of the properties such as light weight, high rigidity and heat resistance which are conventionally possessed of by the fiber-reinforced composite material.

SOLUTION: This member for conveyance made of the fiber-reinforced composite material with resistance to ultraviolet light has an ultraviolet light-resistant coating material formed on the surface of the fiber-reinforced composite material. A fiber-reinforced plastics or a carbon fiber-reinforced carbon composite material is used as the preferable fiber-reinforced composite material. Further, one or two or more kinds selected from the group of a ceramics, cermet, metal and an alloy are used as the ultraviolet



light-resistant coating material. The ultraviolet light resistance is ensured by coating the surface of the fiber-reinforced composite material using a flame spray coating process with the ultraviolet light-resistant coating material. The manufacturing method for the member for conveyance made of the fiber-reinforced composite material is also provided.

---

#### LEGAL STATUS

[Date of request for examination] 10.09.2003

[Date of sending the examiner's decision of rejection]

[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]

[Date of final disposal for application]

[Patent number] 3565765

[Date of registration] 18.06.2004

[Number of appeal against examiner's decision of rejection]

[Date of requesting appeal against examiner's decision of rejection]

[Date of extinction of right]

Copyright (C); 1998,2003 Japan Patent Office

\* NOTICES \*

JPO and NCIPi are not responsible for any damages caused by the use of this translation.

1. This document has been translated by computer. So the translation may not reflect the original precisely.
2. \*\*\*\* shows the word which can not be translated.
3. In the drawings, any words are not translated.

---

CLAIMS

---

[Claim(s)]

[Claim 1] The member for conveyance made from a fiber reinforced composite material which has the ultraviolet-rays resistance in which a spraying process comes to form an ultraviolet-rays-proof cladding material layer on the surface of a fiber reinforced composite material.

[Claim 2] The member for conveyance made from a fiber reinforced composite material in which a fiber reinforced composite material according to claim 1 has the ultraviolet-rays resistance which consists of fiber reinforced plastics or a carbon fiber strengthening graphite composite material.

[Claim 3] The member for conveyance made from a fiber reinforced composite material which has the ultraviolet-rays resistance characterized by consisting of 1 or two or more ingredients which are chosen from the group which an ultraviolet-rays-proof cladding material according to claim 1 or 2 becomes from a ceramic, a cermet, a metal, and an alloy.

[Claim 4] The manufacture approach of the member for conveyance made from a fiber reinforced composite material of having the ultraviolet-rays resistance characterized for having covered the ultraviolet-rays-proof cladding material with the spraying process for the front face of a fiber reinforced composite material by \*\*.

[Claim 5] The manufacture approach of the member for conveyance made from a fiber reinforced composite material that a fiber reinforced composite material according to claim 4 has the ultraviolet-rays resistance which consists of fiber reinforced plastics or a carbon fiber strengthening graphite composite material.

[Claim 6] The manufacture approach of the member for conveyance made from a fiber reinforced composite material of having the ultraviolet-rays resistance characterized by consisting of 1 or two or more ingredients which are chosen from the group which an ultraviolet-rays-proof cladding material according to claim 4 or 5 becomes from a ceramic, a cermet, a metal, and an alloy.

---

[Translation done.]

**JAPANESE** [JP,2001-322198,A]

---

CLAIMS DETAILED DESCRIPTION TECHNICAL FIELD PRIOR ART EFFECT OF THE  
INVENTION TECHNICAL PROBLEM MEANS EXAMPLE DESCRIPTION OF DRAWINGS  
DRAWINGS CORRECTION OR AMENDMENT

---

[Translation done.]

\* NOTICES \*

JPO and NCIPi are not responsible for any damages caused by the use of this translation.

- 1.This document has been translated by computer. So the translation may not reflect the original precisely.
- 2.\*\*\*\* shows the word which can not be translated.
- 3.In the drawings, any words are not translated.

---

DETAILED DESCRIPTION

---

[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to the suitable member made from carbon fiber reinforced composite materia for conveyance and its manufacture approaches of the charge of a precision machine equipment, such as a liquid crystal display and a silicone wafer, especially about the member for conveyance made from a fiber reinforced composite material which has ultraviolet-rays resistance, and its manufacture approach.

[0002]

[Description of the Prior Art] Carbon fiber reinforced plastic and a carbon fiber strengthening graphite composite material are used [ in / repair / industrial ingredients, such as a member of sport leisure goods, such as a golf shaft, a fishing rod, a tennis racket, and skipole, and an industrial robot, a roll for printing ink, and a pressurized container and medical relation, repair of a bridge, / engineering-works / especially / the carbon fiber strengthening graphite composite material ] for the brake material of the aircraft, the brake material of a rapid transit railway, the internal insulation of a reactor, the injection nozzle of a rocket, etc.

[0003] In recent years, with enlargement of a liquid crystal display, it changes to metallic materials, such as conventional aluminum, as a conveyance member of the industrial robot for conveyance of the charge of these precisions machine equipment, and it is light, rigidity is high and the conveyance member made from CFRP with thermal resistance is beginning to be used.

[0004] By the way, the charge of a precision machine equipment has many which dislike contamination by oil, dust, dust, etc. extremely, therefore by irradiating the ultraviolet rays of a vacuum-ultraviolet field depending on a process, the organic substance is disassembled and the approach of carrying out washing removal is adopted. Since the member for conveyance made from the product made from CFRP and a C/C composite is the organic substance, within the equipment which irradiates the ultraviolet rays of a vacuum-ultraviolet field, a front face cannot decompose and it cannot be used as a member for conveyance.

[0005]

[Problem(s) to be Solved by the Invention] This invention conquers the above troubles, and harnessing properties, such as a light weight which the fiber reinforced composite material originally has, high rigidity, and thermal resistance, even if it uses it for the washing processing by ultraviolet rays, it offers the member for conveyance made from a fiber reinforced composite material which cannot pollute the charge of a precision machine equipment easily, and its manufacture approach.

[0006]

[Means for Solving the Problem] (1) This invention relates to the member for conveyance made from a fiber reinforced composite material which has the ultraviolet-rays resistance in which a spraying process comes to form an ultraviolet-rays-proof cladding material layer on the surface of a fiber reinforced composite material.

[0007] (2) This invention relates to the member for conveyance made from a fiber reinforced composite

material in which a fiber reinforced composite material given in (1) has the ultraviolet-rays resistance which consists of FRP or a C/C composite.

[0008] (3) This invention relates to the member for conveyance made from a fiber reinforced composite material which has the ultraviolet-rays resistance characterized by consisting of 1 or two or more ingredients which are chosen from the group which an ultraviolet-rays-proof cladding material (1) or given in (2) becomes from a ceramic, a cermet, a metal, and an alloy.

[0009] (4) This invention relates to the manufacture approach of the member for conveyance made from a fiber reinforced composite material of having the ultraviolet-rays resistance further characterized by covering an ultraviolet-rays-proof cladding material with a spraying process for the front face of a fiber reinforced composite material.

[0010]

[Embodiment of the Invention] As an ultraviolet-rays-proof cladding material covered to the fiber reinforced composite material in this invention, it has ultraviolet-rays resistance, and all can be used if it is the cladding material which does not penetrate ultraviolet rays further.

[0011] it is used in this invention -- ultraviolet rays -- the vocabulary says the thing with a wavelength of 100-260nm which can say a thing with a wavelength of 100-280nm, and can disassemble especially the organic substance easily, and has a washing treatment effect.

[0012] The vocabulary that it has ultraviolet-rays resistance in this invention The UV irradiation trial which repeats ultraviolet rays with a wavelength of 180-254nm in ordinary temperature and ordinary pressure among an air ambient atmosphere using six low pressure mercury lamps of 25W distance [ of a mercury-vapor lamp and a test piece / of 50mm ], and irradiation time [ 1 time of ] 5 - 20 minutes, and 60 counts of an exposure (it is called "a UV irradiation trial" below.) Even if it carries out, the ultraviolet-rays-proof cladding material itself is used to what does not carry out deterioration, decomposition, degradation, crack, and exfoliation.

[0013] As for the vocabulary that ultraviolet rays are not penetrated in this invention, it is desirable that it is the cladding material [ like / (a ratio / specifically as opposed to before a trial / is 90% or more preferably 80% or more) ] with which the member for conveyance made from a fiber reinforced composite material of the base material covered with the ultraviolet-rays-proof cladding material is used to what does not deteriorate, decompose and deteriorate even if it carries out a UV irradiation trial, and the flexural strength of the member for conveyance made from a fiber reinforced composite material hardly falls by UV irradiation trial.

[0014] In this invention, it is the component of the member for conveyance and the fiber reinforced composite material before covering an ultraviolet-rays-proof cladding material is called fiber reinforced composite material.

[0015] In this invention, the vocabulary with the primary member for conveyance made from a fiber reinforced composite material adds primary operation processing of a cutting plane, a polished surface, R processing side, a hole processing side, a recessing side, etc. to a fiber reinforced composite material, and is used to the thing before covering an ultraviolet-rays-proof cladding material.

[0016] In this invention, the vocabulary with the member for conveyance made from a fiber reinforced composite material is used for a fiber reinforced composite material (the primary member made from a fiber reinforced composite material is contained.) to what covered the ultraviolet-rays-proof cladding material.

[0017] As for the thickness of the ultraviolet-rays-proof cladding material used in this invention, it is desirable that it is the thickness which is not penetrated to the fiber reinforced composite material whose ultraviolet rays are base materials, and 50-250 micrometers is the range of the thickness which can be used preferably. It becomes [ when this thickness is thinner than 50 micrometers, there is concern which becomes the lack of thickness in part by covering nonuniformity and in 250 micrometers or more, weight becomes large, and the lightweight nature of the ingredient to be used is checked, and ] an increase of cost and is not desirable.

[0018] The ingredient chosen from the group which consists of a ceramic, a cermet (a ceramic and a metal, or alloy), a metal, and an alloy as a component of an ultraviolet-rays-proof cladding material can

be used. Moreover, as this ultraviolet-rays-proof cladding material, it can also consider as two or more laminated structures using two or more sorts of components.

[0019] As this ceramic, a metallic-oxide system ceramic, a metallic carbide system ceramic, etc. can be used, an alumina, a spinel, a mullite, an alumina titania, a zirconia, chromia, a titania, a garnet, etc. can be used with a metallic-oxide system ceramic, and titanium carbide, chromium carbide, the tungsten carbide, etc. can be used with a metallic carbide system ceramic.

[0020] As this metal and an alloy, aluminum, silicon aluminum, aluminum Nichrome, copper, copper nickel, aluminum bronze, nickel, nickel / aluminide, nickel aluminum / molybdenum, molybdenum, molybdenum / iron can be used.

[0021] It is chosen out of a ceramic and an above-mentioned metal, or an above-mentioned alloy as this cermet, and can be used as 1 or 2 or more mixture, respectively.

[0022] A metal or an alloy can be used for the mixing ratio of a cermet in the range of the 10 - 300 weight section to the ceramic 100 weight section.

[0023] In case the above mentioned ultraviolet-rays-proof cladding material is covered on the front face of said fiber reinforced composite material, it must not take care so that a fiber reinforced composite material is not exposed, or the coat of the formed enveloping layer may become thin and ultraviolet rays may not penetrate an ultraviolet-rays-proof cladding material, and there must not be no especially covering nonuniformity so that there may be no degradation of the member for conveyance by ultraviolet rays.

[0024] There are a plasma metal spray method, a high energy oxy-fuel-spraying method, a CVD method (chemistry gaseous-phase vacuum deposition), etc. in the desirable covering approach, for example, a plasma metal spray method, a high energy oxy-fuel-spraying method, etc. are desirable still more desirable, and there are a wire spraying process, a powder spraying process, a low KAIDO spraying process, a SUFE code spraying process, etc. If a coat is formed by these approaches, ultraviolet-rays-proof cladding materials, such as an alumina, will become opaque, and ultraviolet rays will not be penetrated.

[0025] 50-200 degrees C is desirable, and the temperature of the thermal-spraying-ed side at the time of thermal spraying by this cladding material has inadequate covering below 50 degrees C, and produces curvature or deformation according [ carbon fiber reinforced plastic and/or a carbon fiber strengthening graphite composite material plate ] to heat above dedropping or 200 degrees C which becomes empty and is not desirable.

[0026] In addition, it is effective, especially when the member front face for conveyance can be reformed by processing physically or chemically, the adhesion of this cladding material and the member for conveyance can be increased and it adopts carbon fiber reinforced plastic before the above-mentioned covering processing. There are \*\*\*\*\* (ing) with polish or a sandpaper as these physical processings, a method of ultrasonicing, etc., and there is an approach to which oxidize a part of front face as chemical preparation, or a functional group is made to add, and corona treatment, plasma treatment, the approach of carrying out oxidizer processing, etc. can be adopted.

[0027] In this invention, the primary member which is a base material of the member for conveyance made from a fiber reinforced composite material has the part which the carbon fiber etc. exposed by primary operation, such as a cutting plane, a polished surface, R processing side, a hole processing side, and a recessing side, etc., and after covering processing by the ultraviolet-rays-proof cladding material is performed, in order for a part of such a front face to turn into a split face and to smooth this part, it needs to carry out polish processing as fabricating processing further. As a polish art in this case, it is desirable to use diamond abrasive paper etc.

[0028] As a fiber reinforced composite material of this invention, fiber reinforced composite materials, such as a fiber strengthening ceramic, a fiber strengthening graphite composite material, fiber reinforced metal composite material, and fiber reinforced plastics (henceforth "FRP"), can be used, and FRP, a carbon fiber strengthening graphite composite material (henceforth a "C/C composite"), etc. can be used preferably. Especially the carbon fiber reinforced plastic (henceforth "CFRP") that used the carbon fiber for strengthening fiber as a subject as this FRP is desirable.

[0029] As a matrix used for a fiber reinforced composite material, two or more [ these ] mixture, such as thermosetting resin, thermoplastics, carbon, ceramics, and a metal, can be used, and thermosetting resin, carbon, and such two or more mixture are used especially preferably.

[0030] As this thermosetting resin, thermosetting resin, such as an epoxy resin, aramid resin, a bismaleimide resin, phenol resin, furan resin, a urea-resin, an unsaturated polyester resin, epoxy acrylate resin, diallyl phthalate resin, vinyl ester resin, thermosetting polyimide resin, and melamine resin, can be used.

[0031] As this thermoplastics, resin, such as Nylon, liquid crystallinity aromatic polyamide resin, polyester resin, liquid crystallinity aromatic polyester resin, polypropylene resin, polyether sulphone resin, polyphenylene sulfide resin, polyether ether ketone resin, polysulfone resin, polyvinyl chloride resin, Vinylon resin, aramid resin, and a fluororesin, is used.

[0032] Especially as this ceramics, although not limited, an alumina, a silica, titanium carbide, silicon carbide, nitriding PORON, silicon nitride, etc. can be used.

[0033] Although not limited especially as this metal, alloys which used these 1 and 2 or more, such as titanium, aluminum, tin, silicon, copper, iron, magnesium, chromium, nickel, molybdenum, and a tungsten, can be used.

[0034] As strengthening fiber used in this invention, there are stainless steel fiber, copper fiber, nickel fiber, titanium fiber, tungsten fiber, silicon carbide fiber, an alumina fiber, titanium carbide fiber, boron nitride fiber, a petroleum system pitch carbon fiber, a coal system pitch carbon fiber, a PAN system carbon fiber, a glass fiber, an aramid fiber, a boron fiber, etc., and the fiber which made hybrid construction two or more kinds chosen from the inside of these can be used.

[0035] Since a high rigid lightweight moldings is obtained by it when a carbon fiber is actively used for the member for conveyance made from a fiber reinforced composite material of this invention as strengthening fiber, it can use for it preferably. Moreover, it can also perform suitably combining this carbon fiber with the fiber of a glass fiber, an aramid fiber, stainless steel fiber, copper fiber, nickel fiber, titanium fiber, tungsten fiber, silicon carbide fiber, an alumina fiber, titanium carbide fiber, boron nitride fiber, and others.

[0036] It is not limited especially as a gestalt of the above-mentioned strengthening fiber, but can choose suitably according to the purposes, such as single dimension strengthening, 2-dimensional strengthening, three-dimensions strengthening, and random reinforcement. For example, a staple fiber, textile fabrics, a nonwoven fabric, one direction material, 2-dimensional textiles, three-dimensions textiles, etc. can also more specifically use strengthening fiber, carrying out the laminating of the ingredients, such as direction material, such as the felt, a mat, \*\*\*\*, WARIFU, and false, plain weave, satin, twill, \*\*\*\*\*, and leno weave.

[0037] FRP and CFRP of this invention can use what was manufactured by the usually learned approach. For example, it can sink into the strengthening fiber which processed the above gestalten, thermosetting resin can be made into prepreg at it, and it can be referred to as FRP by carrying out the laminating of these and hardening them further. The method of obtaining the moldings which has a predetermined elastic modulus is the suitable manufacture approach in this invention by using one direction material for strengthening fiber, carrying out orientation suitably in groups, such as 0 degree, \*\*45 degrees, and 90 etc. degrees, and carrying out a laminating especially.

[0038] A skin and a core layer are prepared as an example of the above-mentioned laminating approach. As opposed to the longitudinal direction of the member for conveyance with this final skin - The 1st carbon-fiber-reinforced-plastic layer which carries out orientation to the include-angle range of 20 degrees - +20 degrees, and contains the 1st carbon fiber whose modulus of elasticity in tension is 500-1000GPA, It is made to have the 2nd carbon-fiber-reinforced-plastic layer which carries out orientation to the include-angle range of +75 degrees - +90 degrees and/or -75 degree--90 degree to said longitudinal direction, and contains the 2nd carbon fiber whose modulus of elasticity in tension is 200-400GPA. This core layer It supposes that orientation is carried out to the include-angle range of +30 degrees - +60 degrees and/or -30 degree--60 degree to a longitudinal direction, and the 3rd carbon fiber whose modulus of elasticity in tension is 500-1000GPA is contained, and the approach of using as a skin



and 80 - 60% of the whole core layer is suitable for the thickness ratio of a skin. In addition, a core material can also be used for a core layer and a honeycomb, a porous body, the structure that makes a corrugated plate (corrugated) and has an opening may be used.

[0039] Although there is especially no limitation as an approach of infiltrating thermosetting resin into said strengthening fiber, the so-called hot melt method for usually warming resin at 60-90 degrees C, and infiltrating strengthening fiber is preferably employable. The content of the thermosetting resin in the manufactured prepreg is usually 25 - 45% of the weight of the range preferably 20 to 50% of the weight to the total amount of strengthening fiber and resin.

[0040] To this resin, a filler can be added according to a request, and a mica, an alumina, talc, a fines-like silica, wollastonite, sepiolite, basic magnesium sulfate, a calcium carbonate, polytetrafluoroethylene powder, zinc dust, aluminium powder, an organic particle, i.e., an acrylic particle, an epoxy resin particle, a polyamide particle, a polyurethane particle, etc. are \*\*\*\*\* as this filler.

[0041] Finally said prepreg is fabricated by FRP. For example, it can be referred to as FRP by carrying out the laminating of the prepreg so that it may become the configuration of having been suitable for the member for conveyance, and usually carrying out heat hardening at 110-150 degrees C with a pressurization press among an autoclave etc. for 30 minutes to 3 hours. Obtained FRP has stable quality and what has a few void can be obtained. Since the member for conveyance needs precise process tolerance, obtained FRP is further processible into the configuration of having been suitable for the member for conveyance.

[0042] Moreover, that from which the C/C composite of this invention was also obtained by the usually learned approach can be used. That is, although a carbon fiber can be made into a subject as a C/C composite adopted, other strengthening fiber, such as a glass fiber, is combinable suitably as mentioned above.

[0043] The formation approach of said matrix can use the approach of forming pyrolytic carbon with the approach of sinking a pitch, thermoplastics, thermosetting resin, etc. into strengthening fiber, chemistry gaseous-phase vacuum deposition (CVD), a chemistry gaseous-phase penetration method (CVI), etc.

[0044] An isotropic pitch, a meso phase pitch, etc. which could use the coal pitch, the petroleum pitch, the resultant pitch, etc. as this pitch, and used these pitches as the raw material can be used, and phenol resin, an epoxy resin, furan resin, a urea-resin, etc. can be used as this thermosetting resin.

[0045] A bulking agent, for example, carbon powder, graphite powder, silicon carbide powder, silica powder, a carbon fiber whisker, a carbon staple fiber, a silicon carbide staple fiber, etc. can be mixed to said pitch, thermosetting resin, and thermoplastics, and it can also sink into them.

[0046] It can consider as a C/C composite by sinking matrix resin, such as a pitch and phenol resin, into the carbon fiber processed as mentioned above as the manufacture approach of a C/C composite, for example, and making it sink in and carbonize by these hot isostatic press (HIP) processings etc. as preforming. Using one direction material, like said FRP, the laminating of the carbon fiber can also be carried out so that it may consist of a core layer and a skin.

[0047] As said carbonization conditions, 400-3500 degrees C can usually be preferably heated at 500-3300 degrees C among inert gas.

[0048] Moreover, the obtained C/C composite can carry out eburnation processing, and can raise the consistency of composite material by specifically letting it pass to a repeat matrix formation process.

[0049] The configuration of the member for conveyance made from a fiber reinforced composite material of this invention can have various configurations, such as the shape of the shape of the shape of the shape of the shape of tabular and a rod, and a fork, and a honeycomb, and a hollow rod, and T character, and I character, the shape of a curve side, and these combined configurations, according to an application suitably.

[0050]

[Example] This invention is not limited by these although \*\*\*\* and this invention are concretely explained for an example below.

[0051] In the example, in [ irradiation time ] 10 minutes, 60 times, the UV irradiation trial repeated intermittently 25W low-pressure mercury lamp 6 LGT which has the wavelength of 180-254nm in

ordinary temperature, ordinary pressure, and air, and irradiated it from the distance of 50mm.

[0052] After lengthening and arranging the pitch based carbon fiber of production tensile strength 3500MPa of example 1(1) C / primary member for conveyance made from C composite, modulus-of-elasticity-in-tension 800GPa, and heat-conductivity 300 W/mK with an one direction, the laminating was carried out, the carbonaceous pitch was infiltrated further, pressurization carbonization processing was carried out at pressure 1MPa and the temperature of 1000 degrees C, eburnation processing of the carbonaceous pitch was further repeated and carried out for sinking in and pressurization carbonization, and the one direction strengthening C/C composite was obtained. It was processed into the primary member for conveyance which has die length of 1000mm which has a pad installation hole with a bore of 2.5mm and a coupler installation hole for this one direction strengthening C / C composite, width of face of 380mm, and a configuration with a thickness of 8mm. The orientation of the carbon fiber of a Plastic solid was made to carry out in Point A and the direction of B from the hand section so that the rigidity of a Plastic solid may be enough acquired at this time.

[0053] Thus, the thermal conductivity of the direction where the thermal conductivity of modulus-of-elasticity-in-tension 245GPa and the direction of carbon fiber orientation is perpendicular to 400 W/mK and a carbon fiber was 20 W/mK bulk density 1.90 g/cm<sup>3</sup> of the obtained primary member for conveyance made from a C/C composite, and fiber deposition content  $V_f=60\%$ .

[0054] (2) After the air gun of non-dust removed the surface affix, thermal spraying of what carried out 2mmR processing of the edge of formation aforementioned C / primary member for conveyance made from C composite of an ultraviolet-rays-proof cladding material was carried out so that there might be no exposed part of the primary member for conveyance made from a C/C composite (base material) by the plasma spraying gun and it might become the thickness of about 100 micrometers using the alumina powder of 5 micrometers of mean diameters. The front face was smoothed for the front face of the obtained member for conveyance made from a C/C composite which carried out alumina covering using the diamond abrasive paper of #600, #1000, and #1600.

[0055] (3) The member for conveyance made from a C/C composite in which ultraviolet-rays resistance carried out the test aforementioned alumina thermal spraying was put into the black light, and the UV irradiation trial was carried out. After the exposure, as a result of observing an ejection front face, there is not detailed Chile, there is no change of degradation, a crack, etc. in an ultraviolet-rays-proof cladding material, and deterioration of the C/C composite part which is a base material further, and degradation were not seen.

[0056] (4) The C/C composite of 3 was obtained the consistency of 1.62g/cm<sup>3</sup>  $V_f$ (fiber volume fraction) 40% by sinking into the plain weave fabric which carried out 0 degree of trials, and 90-degree laminating of mechanical physical properties, making a petroleum pitch into preforming at it, and carrying out the pressurization carbonization of this at 2000 degrees C by hot isostatic press processing. The test piece was cut down in die length of 100mm, width of face of 15mm, and thickness of 2mm, the plasma metal spray of this was carried out using the alumina, the 20-micrometer coat was given, and the member for conveyance made from a C/C composite was obtained. Furthermore, when flexural strength was measured after the UV irradiation trial about this member, to these members before an exposure having been 105MPa(s), these members after an exposure are 104MPa(s), and change was not looked at by flexural strength.

[0057] The one direction prepreg sheet which the pitch based carbon fiber of production modulus-of-elasticity-in-tension 800GPa of an example 2 (1) skin was lengthened and arranged with the one direction, and the bismaleimide resin was infiltrated, and was obtained So that the strengthening direction may become 0 degree (namely, this direction) to the direction which should turn into a longitudinal direction of the member for conveyance Moreover, the one direction prepreg sheet which the PAN system carbon fiber of modulus-of-elasticity-in-tension 230GPa was lengthened and arranged with the one direction, and the bismaleimide resin was infiltrated, and was obtained so that the strengthening direction may become 90 degrees (namely, the rectangular direction) to the above-mentioned longitudinal direction The laminating of two or more sheets was carried out, respectively, autoclave processing was carried out and the skin with a thickness of about 1.2mm was produced. In

addition, the volume rate in the core layer of the former prepreg using a pitch based carbon fiber was made into 75%, and the 25 remaining% was taken as the prepreg of the latter which used the PAN system carbon fiber.

[0058] (2) The one direction prepreg sheet which the pitch based carbon fiber of production modulus-of-elasticity-in-tension 600GPa of a core layer was lengthened and arranged with the one direction, and the bismaleimide resin was infiltrated, and was obtained So that the strengthening direction may become  $\pm 45$  degrees to the direction which should turn into the above-mentioned longitudinal direction And two or more sheet laminating of the prepreg which consists of a glass fiber which two or more sheet laminating was carried out [ glass fiber ] so that the volume rate of this prepreg sheet in a core layer might become 5%, and infiltrated the bismaleimide resin into the remaining part was carried out, and the core layer with a thickness of about 5.6mm was produced.

[0059] (3) Arranged the above-mentioned core layer between the production two-layer above-mentioned skins of the primary member for conveyance made from FRP, and joined, and stuck the textiles (Chu-tzu 0.1mm in textile, thickness) of the carbon fiber of modulus-of-elasticity-in-tension 230GPa on the front face of both skins, the cross layer was made to form in it further, and the CFRP plate was obtained. The slot with an installation hole with a bore of 6mm, a vacuum pad installation hole and a width of face [ of 6mm ], and a depth of 2mm was processed into this CFRP plate, and it considered as the primary member for conveyance made from CFRP with die length of 1000mm, a width of face [ of 100mm ], and a thickness of 8.2mm.

[0060] (4) After the air gun of non-dust removed the surface affix for what carried out 2mmR processing of the edge of the primary member for conveyance made from the formation aforementioned CFRP of an ultraviolet-rays-proof cladding material, about 100-micrometer thermal spraying was carried out using 5-micrometer alumina powder so that there might be no exposed part about the primary member for conveyance made from CFRP (base material) by the plasma spraying gun. The front face was smoothed for the front face of the obtained member for conveyance made from CFRP which carried out alumina covering using the diamond abrasive paper of #600, #1000, and #1600.

[0061] (5) The covered member for conveyance made from CFRP in which ultraviolet-rays resistance carried out the test aforementioned alumina thermal spraying was put into the black light, and the UV irradiation trial was carried out. After the exposure, as a result of observing an ejection front face, there is not detailed Chile, there are no degradation and crack of an ultraviolet-rays-proof cladding material, and deterioration of the CFRP part which is a base material, and degradation were not seen.

[0062] (6) 350 degrees-F hardening mold epoxy resin constituent of test of mechanical physical properties was pulled, it sank into the carbon fiber of elastic-modulus 235GPa and tensile strength 3.53GPa, and Vf60% of one direction prepreg was produced. The laminating of this prepreg was carried out, the test piece was cut down after 180 degrees C and 2-hour hardening in die length of 100mm, width of face of 15mm, and thickness of 2mm, the plasma metal spray was carried out using the alumina, and it considered as the member for conveyance made from CFRP which gave the coat with a thickness of 20 micrometers.

[0063] After carrying out a UV irradiation trial about this member, when flexural strength was measured, to these members before an exposure being 750MPa(s), these members after an exposure are 748MPa(s), and change of flexural strength was not seen.

[0064] 1h 50 degrees C were hardened after spreading so that it might become the primary member for conveyance made from CFRP of example of comparison 1 example 2 with the thickness of 30 micrometers about a room-temperature-setting mold ceramic-coating agent {a sky MIKKU solvent-refined-coal clearance (Osaka organic industrial company make) / curing agent =100/10 pile quantitative ratio}.

[0065] This member for conveyance made from CFRP was put into the black light, and the UV irradiation trial was carried out. After the exposure, when the ejection front face was observed, all surface coating was lost and the matrix resin of a CFRP part and a part of CF had received damage by ultraviolet rays.

[0066]

[Effect of the Invention] The member for conveyance made from a fiber reinforced composite material (especially CFRP and/or a C/C composite) of this invention does not have contamination of the charge of a precision machine equipment by the carbon fiber origin, and can demonstrate enough the engine performance of member original for conveyance made from a fiber reinforced composite material of a light weight, thermal resistance, and high rigidity, and according to the manufacture approach of the member for conveyance made from a fiber reinforced composite material of this invention, its front face after processing of an ultraviolet-rays-proof cladding material is still smoother, and it produces neither curvatures, such as this member for conveyance, nor deformation.

---

[Translation done.]

\* NOTICES \*

JPO and NCIPi are not responsible for any damages caused by the use of this translation.

1. This document has been translated by computer. So the translation may not reflect the original precisely.
2. \*\*\*\* shows the word which can not be translated.
3. In the drawings, any words are not translated.

---

TECHNICAL FIELD

---

[Field of the Invention] This invention relates to the suitable member made from carbon fiber reinforced composite materia for conveyance and its manufacture approaches of the charge of a precision machine equipment, such as a liquid crystal display and a silicone wafer, especially about the member for conveyance made from a fiber reinforced composite material which has ultraviolet-rays resistance, and its manufacture approach.

---

[Translation done.]

\* NOTICES \*

JPO and NCIPi are not responsible for any damages caused by the use of this translation.

- 1.This document has been translated by computer. So the translation may not reflect the original precisely.
- 2.\*\*\*\* shows the word which can not be translated.
- 3.In the drawings, any words are not translated.

---

EFFECT OF THE INVENTION

---

[Effect of the Invention] The member for conveyance made from a fiber reinforced composite material (especially CFRP and/or a C/C composite) of this invention does not have contamination of the charge of a precision machine equipment by the carbon fiber origin, and can demonstrate enough the engine performance of member original for conveyance made from a fiber reinforced composite material of a light weight, thermal resistance, and high rigidity, and according to the manufacture approach of the member for conveyance made from a fiber reinforced composite material of this invention, its front face after processing of an ultraviolet-rays-proof cladding material is still smoother, and it produces neither curvatures, such as this member for conveyance, nor deformation.

---

[Translation done.]

\* NOTICES \*

JPO and NCIPi are not responsible for any damages caused by the use of this translation.

- 1.This document has been translated by computer. So the translation may not reflect the original precisely.
- 2.\*\*\*\* shows the word which can not be translated.
- 3.In the drawings, any words are not translated.

---

PRIOR ART

---

[Description of the Prior Art] Carbon fiber reinforced plastic and a carbon fiber strengthening graphite composite material are used [ in / repair / industrial ingredients, such as a member of sport leisure goods, such as a golf shaft, a fishing rod, a tennis racket, and skipole, and an industrial robot, a roll for printing ink, and a pressurized container and medical relation, repair of a bridge, / engineering-works / especially / the carbon fiber strengthening graphite composite material ] for the brake material of the aircraft, the brake material of a rapid transit railway, the internal insulation of a reactor, the injection nozzle of a rocket, etc.

[0003] In recent years, with enlargement of a liquid crystal display, it changes to metallic materials, such as conventional aluminum, as a conveyance member of the industrial robot for conveyance of the charge of these precisions machine equipment, and it is light, rigidity is high and the conveyance member made from CFRP with thermal resistance is beginning to be used.

[0004] By the way, the charge of a precision machine equipment has many which dislike contamination by oil, dust, dust, etc. extremely, therefore by irradiating the ultraviolet rays of a vacuum-ultraviolet field depending on a process, the organic substance is disassembled and the approach of carrying out washing removal is adopted. Since the member for conveyance made from the product made from CFRP and a C/C composite is the organic substance, within the equipment which irradiates the ultraviolet rays of a vacuum-ultraviolet field, a front face cannot decompose and it cannot be used as a member for conveyance.

---

[Translation done.]

\* NOTICES \*

JPO and NCIPi are not responsible for any damages caused by the use of this translation.

- 1.This document has been translated by computer. So the translation may not reflect the original precisely.
- 2.\*\*\*\* shows the word which can not be translated.
- 3.In the drawings, any words are not translated.

---

EFFECT OF THE INVENTION

---

[Effect of the Invention] The member for conveyance made from a fiber reinforced composite material (especially CFRP and/or a C/C composite) of this invention does not have contamination of the charge of a precision machine equipment by the carbon fiber origin, and can demonstrate enough the engine performance of member original for conveyance made from a fiber reinforced composite material of a light weight, thermal resistance, and high rigidity, and according to the manufacture approach of the member for conveyance made from a fiber reinforced composite material of this invention, its front face after processing of an ultraviolet-rays-proof cladding material is still smoother, and it produces neither curvatures, such as this member for conveyance, nor deformation.

---

[Translation done.]



\* NOTICES \*

JPO and NCIPI are not responsible for any damages caused by the use of this translation.

- 1.This document has been translated by computer. So the translation may not reflect the original precisely.
- 2.\*\*\*\* shows the word which can not be translated.
- 3.In the drawings, any words are not translated.

---

TECHNICAL PROBLEM

---

[Problem(s) to be Solved by the Invention] This invention conquers the above troubles, and harnessing properties, such as a light weight which the fiber reinforced composite material originally has, high rigidity, and thermal resistance, even if it uses it for the washing processing by ultraviolet rays, it offers the member for conveyance made from a fiber reinforced composite material which cannot pollute the charge of a precision machine equipment easily, and its manufacture approach.

---

[Translation done.]

\* NOTICES \*

JPO and NCIPi are not responsible for any damages caused by the use of this translation.

- 1.This document has been translated by computer. So the translation may not reflect the original precisely.
- 2.\*\*\*\* shows the word which can not be translated.
- 3.In the drawings, any words are not translated.

---

MEANS

---

[Means for Solving the Problem] (1) This invention relates to the member for conveyance made from a fiber reinforced composite material which has the ultraviolet-rays resistance in which a spraying process comes to form an ultraviolet-rays-proof cladding material layer on the surface of a fiber reinforced composite material.

[0007] (2) This invention relates to the member for conveyance made from a fiber reinforced composite material in which a fiber reinforced composite material given in (1) has the ultraviolet-rays resistance which consists of FRP or a C/C composite.

[0008] (3) This invention relates to the member for conveyance made from a fiber reinforced composite material which has the ultraviolet-rays resistance characterized by consisting of 1 or two or more ingredients which are chosen from the group which an ultraviolet-rays-proof cladding material (1) or given in (2) becomes from a ceramic, a cermet, a metal, and an alloy.

[0009] (4) This invention relates to the manufacture approach of the member for conveyance made from a fiber reinforced composite material of having the ultraviolet-rays resistance further characterized by covering an ultraviolet-rays-proof cladding material with a spraying process for the front face of a fiber reinforced composite material.

[0010]

[Embodiment of the Invention] As an ultraviolet-rays-proof cladding material covered to the fiber reinforced composite material in this invention, it has ultraviolet-rays resistance, and all can be used if it is the cladding material which does not penetrate ultraviolet rays further.

[0011] it is used in this invention -- ultraviolet rays -- the vocabulary says the thing with a wavelength of 100-260nm which can say a thing with a wavelength of 100-280nm, and can disassemble especially the organic substance easily, and has a washing treatment effect.

[0012] The vocabulary that it has ultraviolet-rays resistance in this invention The UV irradiation trial which repeats ultraviolet rays with a wavelength of 180-254nm in ordinary temperature and ordinary pressure among an air ambient atmosphere using six low pressure mercury lamps of 25W distance [ of a mercury-vapor lamp and a test piece / of 50mm ], and irradiation time [ 1 time of ] 5 - 20 minutes, and 60 counts of an exposure (it is called "a UV irradiation trial" below.) Even if it carries out, the ultraviolet-rays-proof cladding material itself is used to what does not carry out deterioration, decomposition, degradation, crack, and exfoliation.

[0013] As for the vocabulary that ultraviolet rays are not penetrated in this invention, it is desirable that it is the cladding material [ like / (a ratio / specifically as opposed to before a trial / is 90% or more preferably 80% or more) ] with which the member for conveyance made from a fiber reinforced composite material of the base material covered with the ultraviolet-rays-proof cladding material is used to what does not deteriorate, decompose and deteriorate even if it carries out a UV irradiation trial, and the flexural strength of the member for conveyance made from a fiber reinforced composite material hardly falls by UV irradiation trial.

[0014] In this invention, it is the component of the member for conveyance and the fiber reinforced composite material before covering an ultraviolet-rays-proof cladding material is called fiber reinforced

composite material.

[0015] In this invention, the vocabulary with the primary member for conveyance made from a fiber reinforced composite material adds primary operation processing of a cutting plane, a polished surface, R processing side, a hole processing side, a recessing side, etc. to a fiber reinforced composite material, and is used to the thing before covering an ultraviolet-rays-proof cladding material.

[0016] In this invention, the vocabulary with the member for conveyance made from a fiber reinforced composite material is used for a fiber reinforced composite material (the primary member made from a fiber reinforced composite material is contained.) to what covered the ultraviolet-rays-proof cladding material.

[0017] As for the thickness of the ultraviolet-rays-proof cladding material used in this invention, it is desirable that it is the thickness which is not penetrated to the fiber reinforced composite material whose ultraviolet rays are base materials, and 50-250 micrometers is the range of the thickness which can be used preferably. It becomes [ when this thickness is thinner than 50 micrometers, there is concern which becomes the lack of thickness in part by covering nonuniformity and in 250 micrometers or more, weight becomes large, and the lightweight nature of the ingredient to be used is checked, and ] an increase of cost and is not desirable.

[0018] The ingredient chosen from the group which consists of a ceramic, a cermet (a ceramic and a metal, or alloy), a metal, and an alloy as a component of an ultraviolet-rays-proof cladding material can be used. Moreover, as this ultraviolet-rays-proof cladding material, it can also consider as two or more laminated structures using two or more sorts of components.

[0019] As this ceramic, a metallic-oxide system ceramic, a metallic carbide system ceramic, etc. can be used, an alumina, a spinel, a mullite, an alumina titania, a zirconia, chromia, a titania, a garnet, etc. can be used with a metallic-oxide system ceramic, and titanium carbide, chromium carbide, the tungsten carbide, etc. can be used with a metallic carbide system ceramic.

[0020] As this metal and an alloy, aluminum, silicon aluminum, aluminum Nichrome, copper, copper nickel, aluminum bronze, nickel, nickel / aluminide, nickel aluminum / molybdenum, molybdenum, molybdenum / iron can be used.

[0021] It is chosen out of a ceramic and an above-mentioned metal, or an above-mentioned alloy as this cermet, and can be used as 1 or 2 or more mixture, respectively.

[0022] A metal or an alloy can be used for the mixing ratio of a cermet in the range of the 10 - 300 weight section to the ceramic 100 weight section.

[0023] In case the above mentioned ultraviolet-rays-proof cladding material is covered on the front face of said fiber reinforced composite material, it must not take care so that a fiber reinforced composite material is not exposed, or the coat of the formed enveloping layer may become thin and ultraviolet rays may not penetrate an ultraviolet-rays-proof cladding material, and there must not be no especially covering nonuniformity so that there may be no degradation of the member for conveyance by ultraviolet rays.

[0024] There are a plasma metal spray method, a high energy oxy-fuel-spraying method, a CVD method (chemistry gaseous-phase vacuum deposition), etc. in the desirable covering approach, for example, a plasma metal spray method, a high energy oxy-fuel-spraying method, etc. are desirable still more desirable, and there are a wire spraying process, a powder spraying process, a low KAIDO spraying process, a SUFE code spraying process, etc. If a coat is formed by these approaches, ultraviolet-rays-proof cladding materials, such as an alumina, will become opaque, and ultraviolet rays will not be penetrated.

[0025] 50-200 degrees C is desirable, and the temperature of the thermal-spraying-ed side at the time of thermal spraying by this cladding material has inadequate covering below 50 degrees C, and produces curvature or deformation according [ carbon fiber reinforced plastic and/or a carbon fiber strengthening graphite composite material plate ] to heat above dedropping or 200 degrees C which becomes empty and is not desirable.

[0026] In addition, it is effective, especially when the member front face for conveyance can be reformed by processing physically or chemically, the adhesion of this cladding material and the member

for conveyance can be increased and it adopts carbon fiber reinforced plastic before the above-mentioned covering processing. There are \*\*\*\*\* (ing) with polish or a sandpaper as these physical processings, a method of ultrasonication, etc., and there is an approach to which oxidize a part of front face as chemical preparation, or a functional group is made to add, and corona treatment, plasma treatment, the approach of carrying out oxidizer processing, etc. can be adopted.

[0027] In this invention, the primary member which is a base material of the member for conveyance made from a fiber reinforced composite material has the part which the carbon fiber etc. exposed by primary operation, such as a cutting plane, a polished surface, R processing side, a hole processing side, and a recessing side, etc., and after covering processing by the ultraviolet-rays-proof cladding material is performed, in order for a part of such a front face to turn into a split face and to smooth this part, it needs to carry out polish processing as fabricating processing further. As a polish art in this case, it is desirable to use diamond abrasive paper etc.

[0028] As a fiber reinforced composite material of this invention, fiber reinforced composite materials, such as a fiber strengthening ceramic, a fiber strengthening graphite composite material, fiber reinforced metal composite material, and fiber reinforced plastics (henceforth "FRP"), can be used, and FRP, a carbon fiber strengthening graphite composite material (henceforth a "C/C composite"), etc. can be used preferably. Especially the carbon fiber reinforced plastic (henceforth "CFRP") that used the carbon fiber for strengthening fiber as a subject as this FRP is desirable.

[0029] As a matrix used for a fiber reinforced composite material, two or more [ these ] mixture, such as thermosetting resin, thermoplastics, carbon, ceramics, and a metal, can be used, and thermosetting resin, carbon, and such two or more mixture are used especially preferably.

[0030] As this thermosetting resin, thermosetting resin, such as an epoxy resin, aramid resin, a bismaleimide resin, phenol resin, furan resin, a urea-resin, an unsaturated polyester resin, epoxy acrylate resin, diallyl phthalate resin, vinyl ester resin, thermosetting polyimide resin, and melamine resin, can be used.

[0031] As this thermoplastics, resin, such as Nylon, liquid crystallinity aromatic polyamide resin, polyester resin, liquid crystallinity aromatic polyester resin, polypropylene resin, polyether sulphone resin, polyphenylene sulfide resin, polyether ether ketone resin, polysulfone resin, polyvinyl chloride resin, Vinyon resin, aramid resin, and a fluororesin, is used.

[0032] Especially as this ceramics, although not limited, an alumina, a silica, titanium carbide, silicon carbide, nitriding PORON, silicon nitride, etc. can be used.

[0033] Although not limited especially as this metal, alloys which used these 1 and 2 or more, such as titanium, aluminum, tin, silicon, copper, iron, magnesium, chromium, nickel, molybdenum, and a tungsten, can be used.

[0034] As strengthening fiber used in this invention, there are stainless steel fiber, copper fiber, nickel fiber, titanium fiber, tungsten fiber, silicon carbide fiber, an alumina fiber, titanium carbide fiber, boron nitride fiber, a petroleum system pitch carbon fiber, a coal system pitch carbon fiber, a PAN system carbon fiber, a glass fiber, an aramid fiber, a boron fiber, etc., and the fiber which made hybrid construction two or more kinds chosen from the inside of these can be used.

[0035] Since a high rigid lightweight moldings is obtained by it when a carbon fiber is actively used for the member for conveyance made from a fiber reinforced composite material of this invention as strengthening fiber, it can use for it preferably. Moreover, it can also perform suitably combining this carbon fiber with the fiber of a glass fiber, an aramid fiber, stainless steel fiber, copper fiber, nickel fiber, titanium fiber, tungsten fiber, silicon carbide fiber, an alumina fiber, titanium carbide fiber, boron nitride fiber, and others.

[0036] It is not limited especially as a gestalt of the above-mentioned strengthening fiber, but can choose suitably according to the purposes, such as single dimension strengthening, 2-dimensional strengthening, three-dimensions strengthening, and random reinforcement. For example, a staple fiber, textile fabrics, a nonwoven fabric, one direction material, 2-dimensional textiles, three-dimensions textiles, etc. can also more specifically use strengthening fiber, carrying out the laminating of the ingredients, such as direction material, such as the felt, a mat, \*\*\*\*, WARIFU, and false, plain weave,

satin, twill, \*\*\*\*\*, and leno weave.

[0037] FRP and CFRP of this invention can use what was manufactured by the usually learned approach. For example, it can sink into the strengthening fiber which processed the above gestalten, thermosetting resin can be made into prepreg at it, and it can be referred to as FRP by carrying out the laminating of these and hardening them further. The method of obtaining the moldings which has a predetermined elastic modulus is the suitable manufacture approach in this invention by using one direction material for strengthening fiber, carrying out orientation suitably in groups, such as 0 degree, \*\*45 degrees, and 90 etc. degrees, and carrying out a laminating especially.

[0038] A skin and a core layer are prepared as an example of the above-mentioned laminating approach. As opposed to the longitudinal direction of the member for conveyance with this final skin - The 1st carbon-fiber-reinforced-plastic layer which carries out orientation to the include-angle range of 20 degrees - +20 degrees, and contains the 1st carbon fiber whose modulus of elasticity in tension is 500-1000GPA, It is made to have the 2nd carbon-fiber-reinforced-plastic layer which carries out orientation to the include-angle range of +75 degrees - +90 degrees and/or -75 degree--90 degree to said longitudinal direction, and contains the 2nd carbon fiber whose modulus of elasticity in tension is 200-400GPA. This core layer It supposes that orientation is carried out to the include-angle range of +30 degrees - +60 degrees and/or -30 degree--60 degree to a longitudinal direction, and the 3rd carbon fiber whose modulus of elasticity in tension is 500-1000GPA is contained, and the approach of using as a skin and 80 - 60% of the whole core layer is suitable for the thickness ratio of a skin. In addition, a core material can also be used for a core layer and a honeycomb, a porous body, the structure that makes a corrugated plate (corrugated) and has an opening may be used.

[0039] Although there is especially no limitation as an approach of infiltrating thermosetting resin into said strengthening fiber, the so-called hot melt method for usually warming resin at 60-90 degrees C, and infiltrating strengthening fiber is preferably employable. The content of the thermosetting resin in the manufactured prepreg is usually 25 - 45% of the weight of the range preferably 20 to 50% of the weight to the total amount of strengthening fiber and resin.

[0040] To this resin, a filler can be added according to a request, and a mica, an alumina, talc, a fines-like silica, wollastonite, sepiolite, basic magnesium sulfate, a calcium carbonate, polytetrafluoroethylene powder, zinc dust, aluminium powder, an organic particle, i.e., an acrylic particle, an epoxy resin particle, a polyamide particle, a polyurethane particle, etc. are \*\*\*\*\* as this filler.

[0041] Finally said prepreg is fabricated by FRP. For example, it can be referred to as FRP by carrying out the laminating of the prepreg so that it may become the configuration of having been suitable for the member for conveyance, and usually carrying out heat hardening at 110-150 degrees C with a pressurization press among an autoclave etc. for 30 minutes to 3 hours. Obtained FRP has stable quality and what has a few void can be obtained. Since the member for conveyance needs precise process tolerance, obtained FRP is further processible into the configuration of having been suitable for the member for conveyance.

[0042] Moreover, that from which the C/C composite of this invention was also obtained by the usually learned approach can be used. That is, although a carbon fiber can be made into a subject as a C/C composite adopted, other strengthening fiber, such as a glass fiber, is combinable suitably as mentioned above.

[0043] The formation approach of said matrix can use the approach of forming pyrolytic carbon with the approach of sinking a pitch, thermoplastics, thermosetting resin, etc. into strengthening fiber, chemistry gaseous-phase vacuum deposition (CVD), a chemistry gaseous-phase penetration method (CVI), etc.

[0044] An isotropic pitch, a meso phase pitch, etc. which could use the coal pitch, the petroleum pitch, the resultant pitch, etc. as this pitch, and used these pitches as the raw material can be used, and phenol resin, an epoxy resin, furan resin, a urea-resin, etc. can be used as this thermosetting resin.

[0045] A bulking agent, for example, carbon powder, graphite powder, silicon carbide powder, silica powder, a carbon fiber whisker, a carbon staple fiber, a silicon carbide staple fiber, etc. can be mixed to said pitch, thermosetting resin, and thermoplastics, and it can also sink into them.

[0046] It can consider as a C/C composite by sinking matrix resin, such as a pitch and phenol resin, into

the carbon fiber processed as mentioned above as the manufacture approach of a C/C composite, for example, and making it sink in and carbonize by these hot isostatic press (HIP) processings etc. as preforming. Using one direction material, like said FRP, the laminating of the carbon fiber can also be carried out so that it may consist of a core layer and a skin.

[0047] As said carbonization conditions, 400-3500 degrees C can usually be preferably heated at 500-3300 degrees C among inert gas.

[0048] Moreover, the obtained C/C composite can carry out eburnation processing, and can raise the consistency of composite material by specifically letting it pass to a repeat matrix formation process.

[0049] The configuration of the member for conveyance made from a fiber reinforced composite material of this invention can have various configurations, such as the shape of the shape of the shape of the shape of the shape of tabular and a rod, and a fork, and a honeycomb, and a hollow rod, and T character, and I character, the shape of a curve side, and these combined configurations, according to an application suitably.

---

[Translation done.]

\* NOTICES \*

JPO and NCIPi are not responsible for any damages caused by the use of this translation.

- 1.This document has been translated by computer. So the translation may not reflect the original precisely.
- 2.\*\*\*\* shows the word which can not be translated.
- 3.In the drawings, any words are not translated.

---

EXAMPLE

---

[Example] This invention is not limited by these although \*\*\*\* and this invention are concretely explained for an example below.

[0051] In the example, in [ irradiation time ] 10 minutes, 60 times, the UV irradiation trial repeated intermittently 25W low-pressure mercury lamp 6 LGT which has the wavelength of 180-254nm in ordinary temperature, ordinary pressure, and air, and irradiated it from the distance of 50mm.

[0052] After lengthening and arranging the pitch based carbon fiber of production tensile strength 3500MPa of example 1(1) C / primary member for conveyance made from C composite, modulus-of-elasticity-in-tension 800GPa, and heat-conductivity 300 W/mK with an one direction, the laminating was carried out, the carbonaceous pitch was infiltrated further, pressurization carbonization processing was carried out at pressure 1MPa and the temperature of 1000 degrees C, eburnation processing of the carbonaceous pitch was further repeated and carried out for sinking in and pressurization carbonization, and the one direction strengthening C/C composite was obtained. It was processed into the primary member for conveyance which has die length of 1000mm which has a pad installation hole with a bore of 2.5mm and a coupler installation hole for this one direction strengthening C / C composite, width of face of 380mm, and a configuration with a thickness of 8mm. The orientation of the carbon fiber of a Plastic solid was made to carry out in Point A and the direction of B from the hand section so that the rigidity of a Plastic solid may be enough acquired at this time.

[0053] Thus, the thermal conductivity of the direction where the thermal conductivity of modulus-of-elasticity-in-tension 245GPa and the direction of carbon fiber orientation is perpendicular to 400 W/mK and a carbon fiber was 20 W/mK bulk density 1.90 g/cm<sup>3</sup> of the obtained primary member for conveyance made from a C/C composite, and fiber deposition content Vf=60%.

[0054] (2) After the air gun of non-dust removed the surface affix, thermal spraying of what carried out 2mmR processing of the edge of the primary member for conveyance made from a formation aforementioned C/C composite of an ultraviolet-rays-proof cladding material was carried out so that there might be no exposed part of the primary member for conveyance made from a C/C composite (base material) by the plasma spraying gun and it might become the thickness of about 100 micrometers using the alumina powder of 5 micrometers of mean diameters. The front face was smoothed for the front face of the obtained member for conveyance made from a C/C composite which carried out alumina covering using the diamond abrasive paper of #600, #1000, and #1600.

[0055] (3) The member for conveyance made from a C/C composite in which ultraviolet-rays resistance carried out the test aforementioned alumina thermal spraying was put into the black light, and the UV irradiation trial was carried out. After the exposure, as a result of observing an ejection front face, there is not detailed Chile, there is no change of degradation, a crack, etc. in an ultraviolet-rays-proof cladding material, and deterioration of the C/C composite part which is a base material further, and degradation were not seen.

[0056] (4) The C/C composite of 3 was obtained the consistency of 1.62g/cm Vf(fiber volume fraction) 40% by sinking into the plain weave fabric which carried out 0 degree of trials, and 90-degree laminating of mechanical physical properties, making a petroleum pitch into preforming at it, and

carrying out the pressurization carbonization of this at 2000 degrees C by hot isostatic press processing. The test piece was cut down in die length of 100mm, width of face of 15mm, and thickness of 2mm, the plasma metal spray of this was carried out using the alumina, the 20-micrometer coat was given, and the member for conveyance made from a C/C composite was obtained. Furthermore, when flexural strength was measured after the UV irradiation trial about this member, to these members before an exposure having been 105MPa(s), these members after an exposure are 104MPa(s), and change was not looked at by flexural strength.

[0057] The one direction prepreg sheet which the pitch based carbon fiber of production modulus-of-elasticity-in-tension 800GPa of an example 2 (1) skin was lengthened and arranged with the one direction, and the bismaleimide resin was infiltrated, and was obtained So that the strengthening direction may become 0 degree (namely, this direction) to the direction which should turn into a longitudinal direction of the member for conveyance Moreover, the one direction prepreg sheet which the PAN system carbon fiber of modulus-of-elasticity-in-tension 230GPa was lengthened and arranged with the one direction, and the bismaleimide resin was infiltrated, and was obtained so that the strengthening direction may become 90 degrees (namely, the rectangular direction) to the above-mentioned longitudinal direction The laminating of two or more sheets was carried out, respectively, autoclave processing was carried out and the skin with a thickness of about 1.2mm was produced. In addition, the volume rate in the core layer of the former prepreg using a pitch based carbon fiber was made into 75%, and the 25 remaining% was taken as the prepreg of the latter which used the PAN system carbon fiber.

[0058] (2) The one direction prepreg sheet which the pitch based carbon fiber of production modulus-of-elasticity-in-tension 600GPa of a core layer was lengthened and arranged with the one direction, and the bismaleimide resin was infiltrated, and was obtained So that the strengthening direction may become \*\*45 degrees to the direction which should turn into the above-mentioned longitudinal direction And two or more sheet laminating of the prepreg which consists of a glass fiber which two or more sheet laminating was carried out [ glass fiber ] so that the volume rate of this prepreg sheet in a core layer might become 5%, and infiltrated the bismaleimide resin into the remaining part was carried out, and the core layer with a thickness of about 5.6mm was produced.

[0059] (3) Arranged the above-mentioned core layer between the production two-layer above-mentioned skins of the primary member for conveyance made from FRP, and joined, and stuck the textiles (Chu-tzu 0.1mm in textile, thickness) of the carbon fiber of modulus-of-elasticity-in-tension 230GPa on the front face of both skins, the cross layer was made to form in it further, and the CFRP plate was obtained. The slot with an installation hole with a bore of 6mm, a vacuum pad installation hole and a width of face [ of 6mm ], and a depth of 2mm was processed into this CFRP plate, and it considered as the primary member for conveyance made from CFRP with die length of 1000mm, a width of face [ of 100mm ], and a thickness of 8.2mm.

[0060] (4) After the air gun of non-dust removed the surface affix for what carried out 2mmR processing of the edge of the primary member for conveyance made from the formation aforementioned CFRP of an ultraviolet-rays-proof cladding material, about 100-micrometer thermal spraying was carried out using 5-micrometer alumina powder so that there might be no exposed part about the primary member for conveyance made from CFRP (base material) by the plasma spraying gun. The front face was smoothed for the front face of the obtained member for conveyance made from CFRP which carried out alumina covering using the diamond abrasive paper of #600, #1000, and #1600. <BR> [0061] (5) The covered member for conveyance made from CFRP in which ultraviolet-rays resistance carried out the test aforementioned alumina thermal spraying was put into the black light, and the UV irradiation trial was carried out. After the exposure, as a result of observing an ejection front face, there is not detailed Chile, there are no degradation and crack of an ultraviolet-rays-proof cladding material, and deterioration of the CFRP part which is a base material, and degradation were not seen.

[0062] (6) 350 degrees-F hardening mold epoxy resin constituent of test of mechanical physical properties was pulled, it sank into the carbon fiber of elastic-modulus 235GPa and tensile strength 3.53GPa, and Vf60% of one direction prepreg was produced. The laminating of this prepreg was carried



out, the test piece was cut down after 180 degrees C and 2-hour hardening in die length of 100mm, width of face of 15mm, and thickness of 2mm, the plasma metal spray was carried out using the alumina, and it considered as the member for conveyance made from CFRP which gave the coat with a thickness of 20 micrometers.

[0063] After carrying out a UV irradiation trial about this member, when flexural strength was measured, to these members before an exposure being 750MPA(s), these members after an exposure are 748MPA(s), and change of flexural strength was not seen.

[0064] 1h 50 degrees C were hardened after spreading so that it might become the primary member for conveyance made from CFRP of example of comparison 1 example 2 with the thickness of 30 micrometers about a room-temperature-setting mold ceramic-coating agent {a sky MIKKU solvent-refined-coal clearance (Osaka organic industrial company make) / curing agent =100/10 pile quantitative ratio}.

[0065] This member for conveyance made from CFRP was put into the black light, and the UV irradiation trial was carried out. After the exposure, when the ejection front face was observed, all surface coating was lost and the matrix resin of a CFRP part and a part of CF had received damage by ultraviolet rays.

---

[Translation done.]

\* NOTICES \*

JPO and NCIPi are not responsible for any damages caused by the use of this translation.

- 1.This document has been translated by computer. So the translation may not reflect the original precisely.
- 2.\*\*\* shows the word which can not be translated.
- 3.In the drawings, any words are not translated.

---

DESCRIPTION OF DRAWINGS

---

[Brief Description of the Drawings]

[Drawing 1] It is drawing showing an example of the primary member for conveyance made from a C/C composite obtained in the example 1.

[Drawing 2] It is the partial enlarged drawing of a putt installation hole.

[Description of Notations]

1 Coupler

2 Putt Installation Hole

---

[Translation done.]

\* NOTICES \*

JPO and NCIPi are not responsible for any damages caused by the use of this translation.

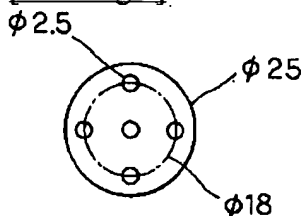
- 1.This document has been translated by computer. So the translation may not reflect the original precisely.
- 2.\*\*\*\* shows the word which can not be translated.
- 3.In the drawings, any words are not translated.

---

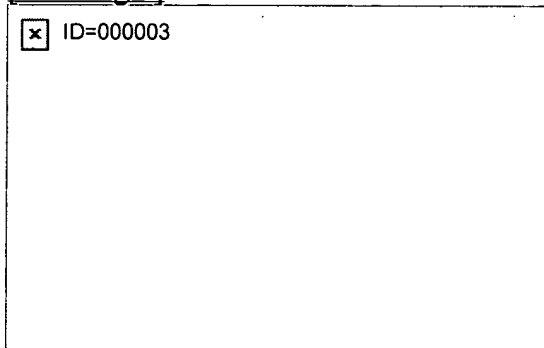
DRAWINGS

---

[Drawing 2]



[Drawing 1]



---

[Translation done.]